

MTS/NAV 2020 FOCUS AREA

Operation Efficiency and Readiness Improvements



TEAM MEMBERS

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OBJECTIVES/GOALS

- **Reduce Life Cycle Operation Cost**
- **Reduce Life Cycle Maintenance Cost**
- **Integrate National Security Requirements**
- **Optimize Capacity**
- **Maximize Throughput (ice, debris, low water)**



GENERAL APPROACH

- **Laboratory/Evaluation Studies**
- **Field Studies/Simulations**
- **Field Demonstrations**
- **Performance/Design Specifications/Tools**



PRIMARY PRODUCTS

- **SUBTASK 1**
 - **Monitoring Tools & Equipment to Optimize Operation – Project Automation**
 - **Real-time monitoring systems for operating equipment**
 - **Capability of Remote Analysis (Lock Data Access from District)**
- **SUBTASK 2**
 - **Quantitative Objective Condition Criteria (Cost Effective)**
 - **Decision Support Tools to Optimize Maintenance & Repair**
- **SUBTASK 3**
 - **District-wide Warehousing of Spare Parts**
 - **Modular Designs**



Primary Products (cont.)

- **SUBTASK 4**
 - Expert System for Automatic Operation of Dam Gates under all Conditions (ice, debris)
- **SUBTASK 5**
 - Guidance for Out-draft Management
- **SUBTASK 6**
 - High resolution Acoustical Imaging for under water inspection and maintenance
- **SUBTASK 7**
 - Better methods for depth and topographic data (e.g. microwave radar pool level device)



Primary Products (cont.)

- **SUBTASK 8**
 - Investigate Feasibility of Real-time monitoring for Towboats (shore data, location GPS, depth)
- **SUBTASK 9**
 - Feasibility of real-time technology to increase capacity
By Vessel Tracking System (radar, low visibility navigation to maximize throughput)
- **SUBTASK 10 (Collaboration with Industry)**
 - Improve Barge-Hull Design for Sediment movement and navigation ice (Industry)
- **SUBTASK 11 (Collaboration with Industry)**
 - Barge coupling connections



Primary Products (Cont.)

- **SUBTASK 12**
 - Design guidance for construction/rehabilitation to include state-of-the-art materials
- **SUBTASK 13**
 - De-icing Techniques



SUB-TASK 1

Condition Monitoring and Predictive Maintenance

- **Description**
 - **Electrical, mechanical and fatigue monitoring of lock and dam gate components**
 - **Use data from sensors (e.g., vibration monitors, strain gages) & interface with Facilities and Equipment Maintenance System (FEMS/MAXIMO)**
 - **Diagnose System Malfunctions**
 - **Provide Engineering Guidelines and Standard Specifications**
- **Approach**
 - **Real-time monitoring of lock and dam from remote location**
 - **Use data trending to correlate with machinery malfunctions/impending failures**
 - **Incorporate corrective/preventive measures into data base**



SUBTASK 1 (Cont.)

Condition Monitoring and Predictive Maintenance

- **Products**
 - **Monitoring Tools & Equipment to Optimize Operation – Project Automation**
 - **Real-time monitoring systems for operating equipment**
 - **Capability of Remote Analysis (Lock Data Access from District)**



SUB-TASK 2

Procedure for Condition Assessment of Navigation Infrastructure

- **Description**
 - Procedure for evaluation of navigation infrastructure for repair and maintenance
 - Prioritizes maintenance activities
 - Provides complement to annual or periodic inspection
- **Approach**
 - Develop simple checklists for inspection and components condition rating
 - Use existing condition indexing to provide tools for more detailed inspections
 - Utilize input from knowledgeable Corps experts
- **Products**
 - Quantitative Objective Condition Criteria (Cost Effective)
 - Decision Support Tools to Optimize Maintenance & Repair



SUB-TASK 3

Rapidly Respond to Project Impairment

- **Description**
 - **System for Centralized supply of interchangeable spare parts within Corps District**
 - **Rapid replacement of critical components**
- **Approach**
 - **Determine which critical parts can easily be warehoused within District**
 - **Develop guidelines for use of modular components**
- **Products**
 - **District-wide Warehousing of Spare Parts**
 - **Modular Designs**



SUBTASK 4

Expert System for Dam control System

- **Description**
 - Automated gate control systems combined with an expert system has potential to maintain a navigable waterway beyond that of current manual operating modes
- **Approach**
 - Evaluate potential need for expert river control
 - Evaluate automated controls for dams
 - Incorporate watershed data, predictive modeling, weather and ice forecasting to optimize pool levels regionally. Expert Systems would not require gate automation



SUBTASK 4

Expert System for Dam Control Systems (Cont.)

- **Products**
 - **Monitoring and Control Design for automated dam gate control**
 - **Expert system template that can readily be adopted to any watershed**
 - **Demonstration project on small waterway or portion of major waterway**



SUBTASK 5

Out-draft Management

- **Description**
 - Reduce delays due to Out-draft
- **Approach**
 - Install Acoustic Doppler Velocimeter (ADV) and real-time video recording system
 - Monitor velocity magnitude and direction to determine when out-draft occurs
- **Products**
 - Guidance for out-draft management



SUBTASK 6

Acoustic Imaging System

- **Description**
 - Man portable and underwater autonomous vehicle (UAV) equipped with high resolution acoustic imaging system for inspection of structural components at locks and dams
- **Approach**
 - Optimize imaging system to penetrate low visibility, muddy water
 - Develop improved real-time image display
- **Products**
 - Diver and/or boat guided HRAIS System
 - Prototype UAV equipped with HRAIS system for underwater inspection



**SUBTASKs 7, 8 and 9 will be covered
by**

Focus Area 3



SUBTASK 10

Barge Design

- **Description**
 - Improve barge design to minimize operation in ice
 - Assess the barge design on re-suspension of sediment
 - More efficient of towboat horsepower
- **Approach**
 - Model studies of barge geometry to movable bed flume
 - Model study of barge geometry in brash ice
- **Products**
 - Guidance for more efficient barge shapes



SUBTASK 11

Barge Coupling Technology (Improvements and Innovations)

- **Description**
 - **Methods to improve efficiency and safety of barge coupling to increase throughput capacity**
- **Approach**
 - **Model and test barge lashing to determine strength requirements.**
 - **Evaluate high performance lightweight materials**
 - **Work with industry to design alternate coupling techniques**
- **Products**
 - **Design Guidance (load/strength requirements)**
 - **Revised Hauser Force limits to promote faster filling/emptying**
 - **Alternative Design for barge coupling system**



SUBTASK 12

Composite Materials

- **Description**
 - **Investigate Feasibility of Using synthetic composite materials in lock construction/rehabilitation**
- **Approach**
 - **Conduct literature review to determine availability of new materials that have potential for use in lock and dam construction/rehab.**
 - **Interview appropriate construction operation and materials research personnel to determine potential applications**
- **Products**
 - **Design Guidance for construction/rehab that will include state-of-the-art materials**



SUBTASK 13

De-icing Techniques

- **Description**
 - Low-adhesion wall cladding/panels to reduce ice accumulation on lock walls, miter gates
 - Develop design guidelines to incorporate wall heaters in new locks or rehabs.
- **Approach**
 - Evaluate low adhesion materials that can be retrofitted to existing locks and tolerate impact from barges
 - Wall heating for new construction with lower life cycle cost
 - Ice control in gate recesses
 - Field Evaluations of low adhesion panels
- **Products**
 - Reduction in ice accumulation will minimize transient time
 - Minimize damage to concrete due to mechanical removal of ice-on-lock components



PRODUCT BENEFITS

- **SUBTASK 1:**
 - Improve safety, security and reliability
 - Reduce likelihood of failure of fracture critical components
 - Life extension of operating equipment
 - Reduce maintenance cost and personnel requirements
- **SUBTASK 2:**
 - Uniform and quantitative assessment of condition and function
 - Prioritization for maintenance activities
- **SUBTASK 3:**
 - Rapid replacement of inoperable components
 - Reduce downtime



PRODUCT BENEFITS

- **SUBTASK 4:**
 - Minimize transient time
 - Optimization of facilities
- **SUBTASK 5:**
 - Minimize Delays
 - Increased throughput
- **SUBTASK 6**
 - Improve underwater inspection capability
 - Reduce need for drivers
- **SUBTASK 7, 8 and 9 to be covered by Focus Area 3**



PRODUCT BENEFITS

- **SUBTASK 10**
 - Improve transient time
 - Lower energy cost and environmental impacts
- **SUBTASK 11:**
 - Improved safety and efficiency for barge coupling
- **SUBTASK 12:**
 - Use of Environmentally Friendly Materials
- **SUBTASK 13:**
 - Better ice reduction techniques



CONNECTIONS

- **TO OTHER EFFORTS**
 - **SUBTASK 1-Continuation of INP work Unit**
 - **SUBTASK 2-Continuation of O&M Funded Work Unit**
 - **SUBTASKs 7, 8, 9 –Focus Area 3**
 - **SUBTASK 12- Infrastructure Technology Program**
- **POTENTIAL FUNDING SOURCES**
 - **General Investigations**
 - **O&M**

